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TITLE: MEASUREMENT OF SELECTED CHEMICALS IN SOIL FROM THE DEAD CREEK SITE - W. G. KRUMMRICH PLANT SAMPLINGS

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ABSTRACT: Eight sediment samples were taken on August 29 (1), September 15 (2), and September 18 (5), 1980 by Monsanto W. G. Krummrich plant representatives. The samples were transferred to our laboratory for analysis. The samples were analyzed for polychlorinated biphenyls, elemental phosphorus, chlorobenzenes, chlorophenols, phosphate esters, and metals (including arsenic and inorganic phosphorus). No elemental phosphorus was detected in any of the samples, which implies that phosphorus is not responsible for the "smoking earth" reported at the site. Varying amounts of the organic chemicals and metals were measured in the soil samples. The results clearly indicate non-uniform contamination at the Dead Creek site.

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MEASUREMENT OF SELECTED CHEMICALS IN SOIL FROM THE DEAD CREEK SITE W. G. KRUMMRICH PLANT SAMPLINGS

INTRODUCTION

Following media reports and subsequent Illinois EPA concern about the hazardous chemicals at the Dead Creek site near Sauget, Illinois, personnel from Monsanto's W. G. Krummrich Plant sampled several areas at the site. Samples were submitted to Environmental Sciences for characterization. Monsanto's concerns about the site arose from reports of high levels of polychlorinated biphenyls and phosphorus, as well as the reported presence of other chemicals, and the proximity of the site to the Krummrich Plant. These samples were taken to give Monsanto opportunity to confirm the reported levels found in earlier samplings by the Illinois EPA. In addition to polychlorinated biphenyls and phosphorus, several other "families" of chemicals were measured to try to identify or eliminate possible sources of the chemicals at the site.

SUMMARY

Eight sediment samples were taken on August 29 (1), September 15 (2), and September 18 (5), 1980 by Monsanto W. G. Krummrich plant representatives. The samples were transferred to our laboratory for analysis. The samples were analyzed for polychlorinated biphenyls, elemental phosphorus, chlorobenzenes, chlorophenols, phosphate esters, and metals (including arsenic and inorganic phosphorus). No elemental phosphorus was detected in any of the samples, which implies that phosphorus is not responsible for the "smoking earth" reported at the site. Varying amounts of the organic chemicals and metals were measured in the soil samples. The results clearly indicate non-uniform contamination at the Dead Creek site.

DETAILS

Sampling

The eight soil samples were collected by Monsanto W. G. Krummrich plant personnel. The Monsanto samples were transferred to the Environmental Analysis Group. In our laboratory, the sediment samples were handled according to Standard Operating Procedure (SOP) EAN-80-SOP-6, Homogenizing, Subdividing and Preserving Sediment Samples. Portions of the soil samples were transferred to Applied Sciences for the determination of metals and arsenic.

Analytical Procedures

The eight soil samples were analyzed for a variety of chemicals using established procedures or methods developed and validated for the chemicals of interest in soil. The following list tabulates the methods which were used.

Analyte	Method No.	Title
Polychlorinated Biphenyls	ES-80-M-28	Determination of Polychlorinated Biphenyls in Soil and Sediment
Chlorinated Benzenes	ES-80-M-29	Determination of Chlorinated Benzenes in Soil and Sediment
Chlorinated Phenols	ES-80-M-30	Determination of Chlorinated Phenols in Soil and Sediment
Elemental Phosphorus (P_4)	ES-80-M-24	Determination of Elemental Phosphorus (P_4) in Soil and Sediment
Phosphate Esters	ES-80-M-5	Determination of Group I Compounds in Sediments. . .
Metals	Ref. 1, 2	Inductively Coupled Plasma (ICP). . . Method for Trace Element Analysis of Water and Wastes
Arsenic	Ref. 3	Methods for Chemical Analysis of Water and Wastes - Arsenic

All determinations were carried out in strict accordance with these methods, except that the polychlorinated biphenyls, chlorinated benzenes and phosphate esters were measured in extracts from acidified samples to facilitate determination of chlorinated phenols in the same extracts.

Results

The analytical results for this study are tabulated in Tables I-VI. Each table contains the results for all of the samples for a specific group of compounds. All results for the soils are in ppm (parts per million or μg/g). In general, the stated detection limits are the lowest level at which a given measurement was validated. Levels which are apparently real, but which are below the validated detection limit are presented in parentheses.

Quality Assurance

The quality assurance results (i.e., recovery and precision evaluations) for these samples have been compiled along with those of similar samples analyzed concurrently. These results are reported in Special Study ES-80-SS-27, Measurement of Selected Chemicals in Soil from the Dead Creek Site - Quality Assurance.

REFERENCES

1. Methods for Chemical Analysis of Waters and Wastes, EPA-600/4-79-020, page: Metals - 6, Section 4.1.3.

2. Federal Register, Vol. 44, No. 233, December 3, 1979.

3. Methods for Chemical Analysis of Waters and Wastes, EPA-600/4-79-020, Method 206 - Arsenic, pages: 206.2-1 to 206.5-2.

TABLE I. PPM LEVELS OF PCBs AND ELEMENTAL PHOSPHORUS (P_4) IN DEAD CREEK SOIL SAMPLES

ANALYTE / ES LOG NO. / DATE SAMPLED / LOCATION	0091541 8/29/80 100' from Judith Ln.	0091542 9/15/80 North Start	0091543 9/15/80 300' from start	0091907 9/18/80 #9	0091908 9/18/80 #10	0091909 9/18/80 #11	0091911 9/18/80 #14	0041701 4/16/80 #15	Soil Blank Mo. Bottoms St.Charles,MO.
PCB's (Cl_2 to Cl_6 Homologs)	29	5000	190	4600	150	730	400	280	ND<1
P_4	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1

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TABLE II. PPM LEVELS OF CHLOROBENZENES IN DEAD CREEK SOIL SAMPLES

ANALYTE / ES LOG NO. / DATE SAMPLED / LOCATION	0091541 8/29/80 100' from Judith Ln.	0091542 9/15/80 North Start	0091543 9/15/80 300' from start	0091907 9/18/80 #9	0091908 9/18/80 #10	0091909 9/18/80 #11	0091910 9/18/80 #14	0091911 9/18/80 #15	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO.
MONOCHLOROBENZENE	NA	NA	NA	(0.9)	2.0	(0.2)	ND<1	(0.1)	ND<1
P-DICHLOROBENZENE	NA	NA	NA	34	4.0	3.4	2.5	(0.7)	ND<1
O-DICHLOROBENZENE	NA	NA	NA	14	(0.5)	1.1	2.3	(0.2)	ND<1
TRICHLOROBENZENES (3)	NA	NA	NA	22	2.0	5.3	3.5	1.1	ND<1
TETRACHLOROBENZENES (3)	NA	NA	NA	4.0	(0.5)	2.1	(0.7)	(0.6)	ND<1
PENTACHLOROBENZENE	NA	NA	NA	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
HEXACHLOROBENZENE	NA	NA	NA	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
NITROCHLOROBENZENES (O-, P-)	NA	NA	NA	ND<5	ND<1	1.2	ND<1	ND<1	ND<1

NA = Not Analyzed

( ) Values in parentheses are below the validated detection limit. However, they represent levels detected with a S/N >2.5 and can be considered semi-quantitative.

TABLE III. PPM LEVELS OF CHLOROPHENOLS IN DEAD CREEK SOIL SAMPLES

ANALYTE / ES LOG NO. / DATE SAMPLED / LOCATION	0091541 8/29/80 100' from Judith Ln.	0091542 9/15/80 North Start	0091543 9/15/80 300' from start	0091907 9/18/80 #9	0091908 9/18/80 #10	0091909 9/18/80 #11	0091910 9/18/80 #14	0091911 9/18/80 #15	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO.
O-CHLOROPHENOL	NA	NA	NA	17	ND<1	1.7	ND<1	ND<1	ND<1
P-CHLOROPHENOL	NA	NA	NA	20	ND<1	1.7	1.4	ND<1	ND<1
2,4-DICHLOROPHENOL	NA	NA	NA	4.6	ND<1	ND<1	ND<1	ND<1	ND<1
PENTACHLOROPHENOL	NA	NA	NA	32	ND<1	1.1	ND<1	ND<1	ND<1

NA = Not analyzed

( ) Values in parentheses are below the validated detection limit. However, they represent levels detected with a S/N >2.5 and can be considered semi-quantitative.

TABLE IV. PPM LEVELS OF PHOSPHATE ESTERS IN DEAD CREEK SOIL SAMPLES

ANALYTE	ES LOG NO. DATE SAMPLED LOCATION	0091541 8/29/80 100' from Judith Ln.	0091542 9/15/80 North Start	0091543 9/15/80 300' from start	0091907 9/18/80 #9	0091908 9/18/80 #10	0091909 9/18/80 #11	0091910 9/18/80 #14	0091911 9/18/80 #15	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO.
DIBUTYLPHENYL PHOSPHATE		ND<1	ND<100	ND<10	60	ND<1	ND<1	1.0	ND<1	ND<1
BUTYLDIPHENYL PHOSPHATE		NA	NA	NA	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
TRIPHENYL PHOSPHATE		(0.3)	150	18	200	3.0	ND<1	ND<1	ND<1	ND<1
2-ETHYLHEXYLDIPHENYL PHOSPHATE		3.5	17	11	ND<1	ND<1	1.0	(0.5)	ND<1	ND<1
ISODECYLDIPHENYL PHOSPHATE		ND<1	ND<100	ND<10	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
T-BUTYLPHENYLDIPHENYL PHOSPHATE		ND<1	ND<100	ND<10	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
DI-T-BUTYLPHENYLPHENYL PHOSPHATE		NA	NA	NA	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
NONYLPHENYLDIPHENYL PHOSPHATE		ND<2	ND<200	ND<20	ND<1	1.0	ND<1	ND<1	ND<1	ND<1
CUMYLPHENYLDIPHENYL PHOSPHATE		ND<1	ND<100	ND<10	2.6	2.4	2.4	2.2	2.6	ND<1

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NA = Not analyzed

( ) Values in parentheses are below the validated detection limit. However, they represent levels detected with a S/N >2.5 and can be considered semi-quantitative.

TABLE V. PPM LEVELS OF METALS IN DEAD CREEK SOIL SAMPLES

ANALYTE / ES LOG NO. / DATE SAMPLED / LOCATION	0091541 8/29/80 100' from Judith Ln.	0091542 9/15/80 North Start	0091543 9/15/80 300' from start	0091907 9/18/80 #9	0091908 9/18/80 #10	0091909 9/18/80 #11	0091910 9/18/80 #14	0091911 9/18/80 #15	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO.
SILVER	17	ND<1	3.3	ND<1	20	20	19	4.2	ND<1
ALUMINUM	2300	720	720	2700	2400	3100	3600	3900	5600
BARIUM	210	2000	640	2400	230	940	1000	1100	120
BERYLLIUM	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
BORON	68	13	21	36	100	78	76	72	27
CALCIUM	2500	2700	2200	13,000	14,000	6200	9200	5600	4600
CADMIUM	60	5.9	17	5.1	40	42	45	53	3.9
COBALT	67	8.2	13	30	120	85	89	81	33
CHROMIUM	44	19	61	29	88	110	130	51	19
COPPER	25,000	2700	16,000	590	8900	13,000	12,000	14,000	19
IRON	24,000	2000	2600	8700	31,000	28,000	28,000	28,000	9900
MAGNESIUM	1000	400	310	1300	1700	1700	2400	2100	2300
MANGANESE	45	15	9.3	60	210	91	140	90	510
MOLYBDENUM	63	9.5	38	11	54	39	38	47	11
SODIUM	350	690	710	420	510	400	440	360	320
NICKEL	950	140	260	120	1100	900	1100	1400	39
LEAD	1000	390	1400	150	1200	1000	1100	1500	50
PHOSPHORUS	4400	770	2400	1900	7400	7000	6500	6700	610
ANTIMONY	130	23	54	22	160	93	88	120	29
SILICON	210	320	270	94	83	91	63	95	110
TIN	76	27	71	19	71	78	91	62	18
STRONTIUM	64	35	42	24	130	120	110	81	17
TITANIUM	49	60	94	36	56	50	47	51	37
VANADIUM	46	13	14	67	120	92	100	110	130
ZINC	20,000	1400	5900	380	19,000	11,000	10,000	18,000	56
ARSENIC (By AA)	NA	NA	NA	180	50	90	50	30	5

NA = Not analyzed

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TABLE VI. SUMMARY OF PHOSPHORUS CONTENT (PPM) OF DEAD CREEK SOIL SAMPLES

ANALYTE / ES LOG NO. / DATE SAMPLED / LOCATION	0091541 8/29/80 100' from Judith Ln.	0091542 9/15/80 North Start	0091543 9/15/80 300' from start	0091907 9/18/80 #9	0091908 9/18/80 #10	0091909 9/18/80 #11	0091910 9/18/80 #14	0091911 9/18/80 #15	0041701 4/16/80 Soil Blank Mo. Bottoms St.Charles,MO
P - ELEMENTAL, By GC/MS	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1
P-INORGANIC, By ICP	4400	770	2400	1900	7400	7000	6500	6700	610
TOTAL PHOSPHATE ESTERS, By GC/MS	4	170	29	260	6.4	3.4	3.7	2.6	ND<10

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